Two Markets and a Weak Link

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EXTENDED ABSTRACT

As natural gas industries are liberalized around the world, interconnectors have become important competitive linkages between otherwise isolated markets, and thus have the potential to mitigate local market power. Still, a number of empirical questions remain open concerning how the operations of these interconnectors influence prices. These include whether congestion can be created strategically so as to split the local markets, and how flow disruptions influence their price dynamics. This paper analyses the two questions using data from the Bacton (UK)-Zeebrugge (Belgium) natural gas pipeline.

Strategically created congestion has been studied primarily in the electricity context and often rationalized through models of physical capacity withholding (e.g. Bushnell, 1999). A firm s price setting ability depends on the degree of market competition at the margin so, in these models, one usually finds a direct link between the degree of capacity utilization and its marginal price, which should result in the local markets splitting before the interconnection reaches technical congestion levels.

In contrast, prevalent models based on the Law of One Price (LOOP) often conclude that market splitting would not occur. Their reasoning is as follows: the interconnectors main cost component is typically fixed and sunk, while marginal transportation costs are close to zero. Hence, if those holding rights and those interested in exercising them traded competitively, arbitrage would tend to equalize the local prices and interconnector charges would be low. Thus, in the absence of other transportation costs and restrictions to trade, the commodity should be uniformly priced, making arbitrage impossible. Further, a somewhat surprising corollary follows: as long as capacity is large enough, no output might actually flow along the interconnector. The threat of competition and arbitrage will be all that is needed for effective integration of the two markets and the infrastructure may appear to be under-utilised (Borenstein et al, 2002).

Some implications of the arbitrage and capacity withholding models can be phrased as testable hypotheses. If the LOOP were to hold between the two markets, their price differences would be stationary and the interconnector would remain either idle or totally constrained (e.g. Bower, 2002). Moreover, arbitrage would homogenize the dynamic econometric structures of the two prices, for example incorporating "convergence to the mean" (Cremer and Laffont, 2002) and leader-follower processes.

If there were some form of market power inefficiencies, however, one would expect a significant relationship between capacity utilization and local price differences and that the interconnector may be seldom congested.

Moreover, the two prices could remain largely independent and their dynamic econometric structures different.

To study empirically these questions, a natural setting in which a number of circumstances concur is desirable: First, it should consist of two oligopolistic markets with a single capacity-constrained transportation interconnection between them. Secondly, the interconnection physical rights market would be unregulated and its main owners should be also active in the local markets, so as to have both the opportunity and incentive to withhold capacity. Third, the economic fundamentals of the individual markets should be different, in order to help us determine whether the linkage results in a homogenisation of price dynamics. Finally, the link should ideally suffer from unexpected flow disruptions separating the two, so as to provide an exogenous benchmark to assess the effects of market integration. One such natural setting is the liberalized European natural gas market and, specifically, the new situation that emerges around the building of the interconnector between the UK and the Continent.

There are two main wholesale trading gas hubs in Western Europe, Zeebrugge (Belgium) and the National Balancing Point (NBP) in the United Kingdom. The only linkage between them is the recently built "interconnector", whose ownership is shared among some of the largest players in the industry.

This pipeline is weak in a double sense: its capacity is limited and subject to unexpected technical disruption. Although maintenance operations may be scheduled ahead of time, the interconnector has also suffered a number of unexpected flow interruptions due to system breakdown.

While continental markets are extremely concentrated and still undergoing a slow liberalization, the UK has been competitive for some years. Before the interconnector opened, it is well documented that NBP prices depended mainly on the value of natural gas for electricity generation (e.g. Stern, 1998). As a result, its dynamics were quite linked to those of the more competitive England and Wales spot electricity market. Features of

electricity spot price processes include mean reversion, high volatility and specific seasonal patterns.

In contrast, prices in the Zeebrugge area are linked to long-term take-or-pay (TOP) agreements signed before the liberalization started. TOP contracts were established between large national incumbents and indexed using different formulae that usually reflected the net-back principle, pricing gas at a discount with respect to its competitors (mainly oil products), which are generally less volatile, mean reverting and seasonal than electricity (Pilipovic, 1997). Hence, at the outset, both the market structure and the economic fundamentals of gas prices in the European continent were very different from those in the UK and would be expected to differentiate their dynamic specification.

Whether the arbitrage or market splitting logic dominates is the first issue that we address in this paper. The second question concerns the influence of the degree of interconnector utilisation on the local prices, both in terms of their reciprocal relationship and their dynamic structure. More synthetically, the research questions that we answer are:

Q. 1: Is there a relationship between market splitting and the degree of utilisation of their interconnection?

Q. 2: What is the mediating role of the interconnector utilization on the dynamic relationship between the local prices?

We find that the relationship between price splitting and capacity utilisation is convex, and that market splitting emerges at a lower level than anticipated, with a threshold around 55-60%. Hence, the separate consideration of interconnector closures, low and high interconnector utilisation cases is a step in the direction of establishing the mediating role of congestion in the operation of the LOOP. Moreover, the dynamic results provided subtle insights about the actual interrelationships, which were influenced by splitting and market power.

Firstly, the LOOP operates as a process of convergence to the mean in levels so the interconnector has so far resulted in a price subsidy from British to continental European wholesale buyers. Factors that favour the emergence of more competition (and lower prices) in the UK include a larger number of buyers and sellers, larger volumes of free natural gas at the electricity generation margin, more market transparency and Ofgem s behaviour as successful industry watchdog. Thus, the British Government's idea of the interconnector providing the means by which they could export both their gas and their liberalisation philosophy to the Continent (Stern, 1998) has been replaced in recent years by purchasing cartels (Financial Times, 2000), and official allegations of anti-competitive firm behaviour (Financial Times, 2001).

Second, arbitrage influences not only the absolute price levels but also their structural formation. Traditionally, prices in the UK depended on the dynamics of the wholesale electricity market while in the Continent they were pegged to those of oil. Now, commentators refer to the interconnector becoming a channel of an "oil linkage" to British natural gas prices. The argument works in the long run and also as a justification for the existence of indexed contractual arrangements in the Continent. It might explain why Brent price should influence Zeebrugge but not why it should influence day-ahead UK prices, unless the interconnector funnels the linkage. We found evidence of a migration of price structures that largely homogenizes their dynamics and that depends upon the existence of arbitrage opportunities. Consistent with economic theory, the effect emerges only when physical and economic market integration occurs and there is sufficient idle capacity.

A third general lesson concerns the causality relationship between the two prices. There is substantial evidence of NPB driving Zeebrugge but not the other way around. A number of factors might explain this dependence: 1. The UK trading mechanism is more mature and liquid; 2. Information is more reliable and easier to access in the UK; 3. The connection between electricity and natural gas markets is stronger there, and; 4. Blending

capacity is limited in the Zeebrugge area. These explanations fit well the empirical data and suggest that, in general, when a well-developed market integrates with another that is embryonic, the former tends to take the driving causality role.

Moreover, although logically the two should be determined simultaneously, we found that market splitting preceded the degree of capacity utilisation. A possible explanation for this effect might have to do with the timing of information availability. Real time interconnector data is more difficult to obtain than local market information and might become, as a consequence, subordinate in the price determination process. If that were the case, more interconnector information would not only facilitate market scrutiny but local competition, too.

Finally, if prices had been found to be equivalent during disruptions, it would have been plausible to argument against the economic rationale for having an interconnector in the first place. One would have expected the LOOP to hold at all times so the interconnector s economic value would not have depended upon its arbitrage role but simply as balancing instrument. Congestion (and the economic value of the interconnector) would have been very small under these circumstances (Bower, 2002). In general, though, it was found that the interconnector has sufficient capacity to integrate the two markets.

To our knowledge, there is no previous empirical literature examining the relationship between transportation capacity utilisation and locational prices. Hence, we believe that the above results provide new insights on the management of interconnection infrastructures, which are pertinent to understand the dynamics of the European competitive energy industry.

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